

REMARKS

Reconsideration and allowance of this application are respectfully requested in view of the above amendment and the discussion below.

Applicants' invention, as defined by independent claim 1, is addressed to an engine control system using a NOx catalyst to trap NOx by absorption or storage in an oxidation atmosphere and to emit NOx in a reduction atmosphere. A sensor is located downstream of the trapped catalyst to detect the amount of NOx in the exhaust and a catalyst model estimates the amount of NOx trapped in the catalyst.

Based on this estimated amount, a rich spike control is sent to the engine and a tuning device tunes the parameter of the trap catalyst model based on the output of the sensor while the engine is in operation.

With the present invention, it is possible to correct model error resulting from fluctuations in the NOx catalyst due to product differences of mass produced engines and due to the aging of the engine. This automatic correction is accomplished by tuning the trap ratio of the catalyst based on the output of the NOx sensor during engine operation. As a result, because the model can estimate the NOx trapped in the catalyst precisely, the rich spike start timing and rich spike amount of the NOx trapped catalyst can be optimized so that exhaust can be reduced.

Original claims 1-2 have been rejected under 35 USC §102 as anticipated by Kolmanovsky (U.S. Patent No. 6,347,512), while claims 1-2 and 7-8 are rejected as anticipated by Itou *et al.* (U.S. Patent No. 6,167,695). Allowable subject matter has been indicated in claims 3-6 and 9-10 if rewritten in independent form.

Applicants respectfully traverse these rejections on the grounds that independent claim 1, in its amended form, contains structure not shown or disclosed by either of the references to Kolmanovsky or Itou.

The reference to Kolmanovsky '512 concerns a method and system for controlled management of a lean NO_x trap in order to estimate the feed gas NO_x and CO emissions where the parameters are updated based on exhaust gas oxygen sensors.

According to Kolmanovsky, the system uses a trap catalyst 34 in the exhaust pipe of the engine 20 to trap NO_x by storing in an oxidation atmosphere and emitting NO_x in a reduction atmosphere. Also disclosed in a trap catalyst model for estimating a NO_x amount trapped in the catalyst. There is no disclosure of a NO_x sensor and a tuning device that tunes a parameter of the trapped catalyst model based on the output of the NO_x sensor. The heated exhaust gas oxygen sensor 34 functions as an on-off switch corresponding to oxygen concentration. The time control of the purge cycle from start to end is controlled by equation 4. At the end of the purge cycle, the amount of NO_x

stored in the trap is given by the time control of the purge cycle with Δn being the time interval in the normal mode and Δp being the total time in the purge mode, as indicated at column 3, lines 63-67, and column 4, lines 1-20. The exhaust gas oxygen sensor determines whether the time control of the purge cycle is implemented in an appropriate manner and, if there is an error, the parameter of the time control is updated.

In contradistinction, the presently claimed invention does not use the determination method of the time control of the purge cycle in Kolmanovsky.

Applicants' invention resulted from their finding that NO_x trapped in the catalyst is reduced into N₂ by HC and CO during the rich spike operation while a part of NO_x is not reduced and is exhausted. The reason for this failure to reduce the entire portion of NO_x is the insufficiency of the reducing agent and the reaction probability. Thus, if the amount of reducing agents applied and the reaction probability are known, it is possible to estimate the NO_x amount trapped by detecting the non-reduced NO_x with the NO_x sensor downstream of the catalyst as is provided in the present invention. Thus, the device of the present invention performs this estimation based on detected value of the NO_x sensor as indicated at page 7, lines 13-24. The parameter of the NO_x trap catalyst model is tuned based on the result of a comparison of the amount estimated by the trap catalyst model with the estimation based on detected

values of the NOx sensor. This claimed structure is part of independent claim 1 and is not disclosed by Kolmanovsky.

With respect to the reference to Itou, there is a disclosure of a catalyst 22 in the exhaust pipe to trap NOx by storage in an oxidation atmosphere and also emit in a reduction atmosphere. A NOx sensor 24 is located downstream of the catalyst to detect NOx components in the exhaust and a catalyst model estimates the amount trapped in the catalyst. The reference to Itou does not disclose a tuning device that tunes a parameter of the trap catalyst model based on the output of the NOx sensor, as is specifically claimed in independent claim 1. The NOx sensor of Itou is only used for determining that the NOx catalyst is deteriorating.

In summation, neither Kolmanovsky nor Itou have the tuning device claimed in independent claim 1, wherein the parameter of the trap catalyst model is tuned based on the output of the NOx sensor, while the engine is in operation.

Claim 3 has been amended to incorporate the subject matter of independent original claim 1 to take advantage of the allowable subject matter indicated in the Office Action. Each of the remaining claims 4-12 depend directly or indirectly from and contain all the limitations of either independent claim 1 or independent claim 3.

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Amendment Dated:
Reply to Office Action

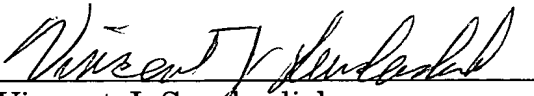
Therefore, Applicants respectfully request that this application containing claims 1-12 be allowed and be passed to issue including newly added dependent claims 11 and 12 which depend from amended independent claim 1.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #056208.52852US).

Respectfully submitted,

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